

# Alternative Nonvolatile Residue Analysis with Contaminant Identification Project

Center Independent Research & Developments: KSC IRAD Program | Science Mission Directorate (SMD)



## ABSTRACT

Cleanliness verification is required in numerous industries including spaceflight ground support, electronics, medical and aerospace. Currently at KSC requirement for cleanliness verification use solvents that environmentally unfriendly. This goal of this project is to produce an alternative cleanliness verification technique that is both environmentally friendly and more cost effective.

## ANTICIPATED BENEFITS

### To NASA funded missions:

1. **Increased safety**
2. **Reduced environmental impacts**
3. **No harmful emissions or waste stream**
4. **Lower life cycle cost**
5. **Lower per sample costs**
6. **Provides quantification and ID in one step which will assist root cause analysis**
7. **Lower Processing time**

### To NASA unfunded & planned missions:

1. **Increased safety**
2. **Reduced environmental impacts**
3. **No harmful emissions or waste stream**
4. **Lower life cycle cost**
5. **Lower per sample costs**
6. **Provides quantification and ID in one step which will assist root cause analysis**
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### To the commercial space industry:

Cleanliness verification is required in numerous industries including spaceflight ground support, electronics, medical and

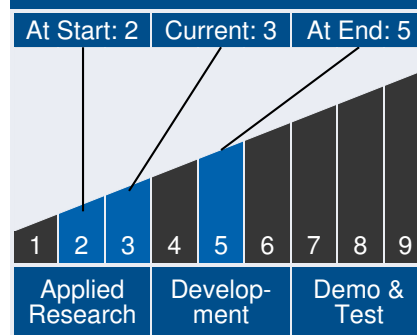


Alternative NVR Chamber

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## Technology Maturity



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## DETAILED DESCRIPTION

This purpose of this project is to develop an improved method for nonvolatile residue (NVR) analysis using the Direct Analysis in Real Time Mass Spectrometry (DART-MS). DART technology has been used for detection and identification of trace contaminants on a wide range of materials, from counterfeit pharmaceuticals to illicit drugs on paper currency. NVR is essentially a contaminant on flight hardware and as such should be readily detectable via DART analysis. The primary challenge will be developing a means of sampling components with complex, three-dimensional geometries. Researchers will develop identification and quantitative analysis procedures to determine NVR levels for precision cleaned components. This project is in process and updates as to the progress will be submitted.

### Management Team

**Program Director:**

- Burton Summerfield

**Program Executive:**

- Karen Thompson

**Program Manager:**

- Pamela Mullenix

**Project Manager:**

- Nancy Zeitlin

**Principal Investigator:**

- Kathleen Loftin

### Technology Areas

**Primary Technology Area:**

Ground & Launch Systems  
Processing (TA 13)

**Secondary Technology Area:**

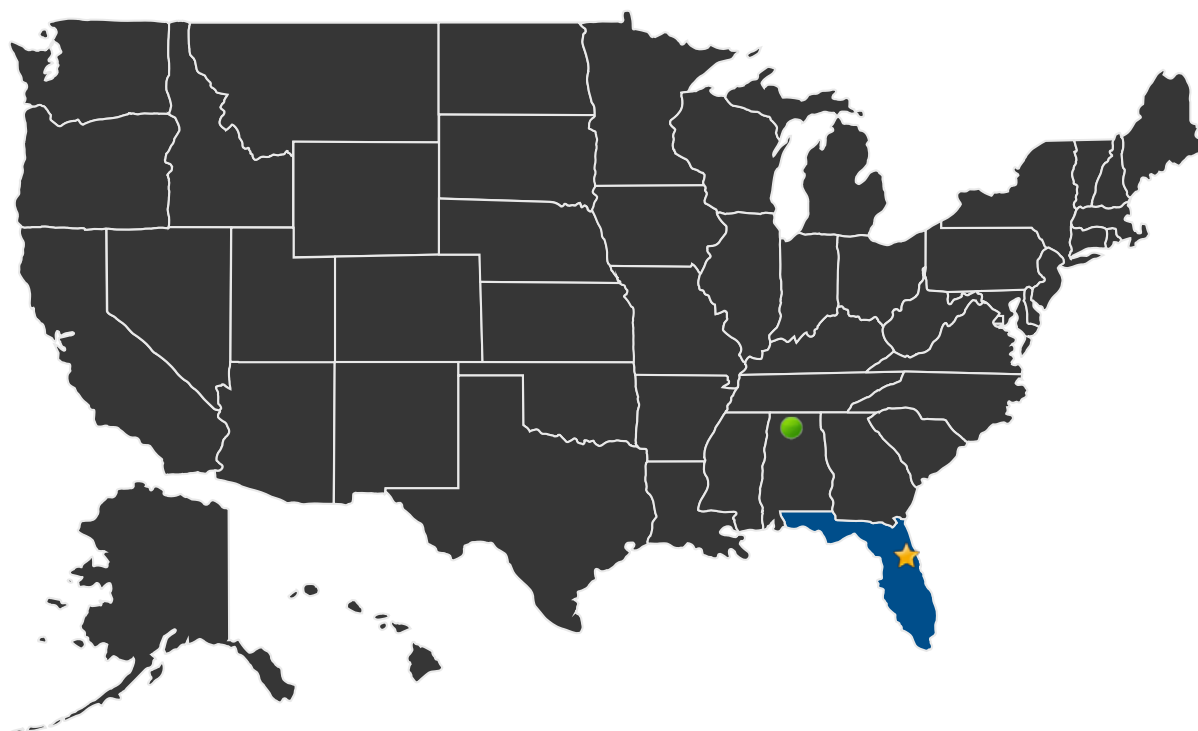
Science Instruments,  
Observatories & Sensor  
Systems (TA 8)

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## U.S. LOCATIONS WORKING ON THIS PROJECT



■ U.S. States With Work      ★ **Lead Center:**  
Kennedy Space Center

● **Supporting Centers:**  
• Marshall Space Flight Center

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## DETAILS FOR TECHNOLOGY 1

### Technology Title

New Analytical Methodology for Non Volatile Residue Analysis

### Technology Description

This technology is categorized as a hardware system for ground scientific research or analysis

Nonvolatile residue (NVR) is essentially a contaminant on flight hardware and as such should be readily detectible via DART analysis. Researchers will develop identification and quantitative analysis procedures to determine NVR levels for precision cleaned components. This alternative technology will reduce the need for toxic solvents currently used in the traditional methodology.

### Capabilities Provided

This will be an alternate capability to traditional nonvolatile residue analysis used to determine contamination on spaceflight hardware.

### Potential Applications

Precision cleaning verification for spaceflight hardware and other industries requiring precision cleaning.

### Performance Metrics

Metric	Unit	Quantity
KSC- 123 a	mg	5